P.O.L. INSIGHT

A Continuing Education Publication for the Physician Office Laboratory

Event 2005-C
Issue 44

Issue Features

AAFPPT
The Physician's Proficiency Testing Program

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Published by the American Academy of Family Physicians, 11400 Tomahawk Creek Parkway, Leawood, KS 66211-2672.

Editor and Writer:
Lisa R. Henderson, MPA, M.T.(ASCP), NCA(CLS)

Writers:
Chuck Hiar, MS, MT(ASCP)
Linda E. Schrock, MN, RN, CS, CDE

American Academy of Family Physicians

AAFP-PT Staff

Barbara Mitchell
Program Manager
e-mail bmitchel@aafp.org

Lisa Henderson
Manager, Operations
e-mail lhenders@aafp.org

Beth Ming
Manager, Client Services
e-mail bming@aafp.org

Shaurna Williams
Program Coordinator
e-mail swilliam@aafp.org

Karen Bergman
Program Coordinator
e-mail kbergman@aafp.org

AAFP-PT FAX
913-906-6079

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CME Learning Objectives

Following completion of the self-instructional material, the participant will be able to:

1. To discuss common interfering substances to urine reagent strip test methods. Information on both chemical and physical interferences will be provided to assist testing personnel in the proper interpretation of reagent strip results.
2. To instruct diabetic patients on how to self-monitor blood glucose levels.
3. To implement new consensus standards in performing venipunctures.

To earn the CME, answer the questions included with this issue of the *Insight*, using the form included, or submit the test online at **www.aafp.org/pt** – click on Continuing Medical Education

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Event 2005-A ..... February 28, 2006 254-001-05
Event 2005-B ..... May 31, 2006 254-002-05
Event 2005-C ..... September 30, 2006 254-003-05

Urinalysis Reagent Strip Interferences

By Chuck Hiar, MS, MT(ASCP)
Product Specialist-Reference/Proficiency Laboratory
Bayer HealthCare, Diagnostics Division

This is the second of two articles that focus on the proper usage of urine reagent strips in the performance of a urinalysis. The previous article reviewed strip storage and handling, testing technique, specimen collection and quality control. This article focuses on factors that interfere with reagent strip test results. Knowledge of these factors will further enhance the clinical information that can be obtained from the proper performance of the chemical portion of the urinalysis.

Interferences with reagent strip tests can be physiologic or chemical. Physiologic interferences change the true concentration of a measured analyte in urine and thus may cause misinterpretation of the patient's clinical condition. The primary physiological interferences are volume rate of excretion (diuresis), exercise and/or body posture, incubation time of urine in the bladder and specimen contamination. Chemical interferences alter the reagent pad chemical reactions. These factors are particularly important because of the semi-quantitative nature of the methods that have varying degrees of sensitivity and specificity.[1]

Many urine constituents change in concentration when urine volume is altered due to fluid intake, reduction of renal concentrating power or ingestion of diuretic substances. If sensitive screening is required, the first morning collection is preferred. A patient who is fasting before specimen collection will generally have reduced diuresis and the urine specimen may be collected at the same time as a fasting blood specimen.

Testing a first morning specimen can also minimize the effects of exercise and body posture. Exercise may increase the excretion of certain constituents by increasing glomerular filtration as a result of increased blood pressure. This can cause a transient elevation of albumin or hemoglobin (blood) in the urine.

Protein concentration in the urine is a good example of an analyte that is sensitive to diuresis and/or exercise effects. This can result in highly concentrated or dilute urine specimens. To minimize these effects, reagent strips are now available that include a creatinine test. The creatinine concentration, along with the conventional protein or albumin result, is then used to calculate protein-to-creatinine or albumin-to-creatinine ratios. These ratios more accurately reflect the protein excretion by the kidneys, and the tests can be performed on random, rather than timed urine specimen collections.

Incubation time of urine in the bladder is an important consideration for several reasons. As indicated in the previous article, urine is a good culture medium and an improper specimen collection may lead to misinterpretation of the nitrite test. Incubation time in the bladder for 4-8 hours is the optimum. However, the urgency of micturation, which accompanies a bladder infection, may not allow for an extended incubation time and a false negative test may result. It should be noted that a much shorter time of 1-2 hours incubation is preferred for studying cell and cast morphology, provided a high urine output does not lead to false negatives because of few cellular constituents.[1]

Contamination of urine from various internal and external fluids may also interfere with test interpretation. Vaginal secretions or menstrual blood may contaminate urine specimens from females. Pregnancy is also associated with physiological pyuria.[1] Sexual intercourse should be avoided for one day prior to specimen collection because of contamination by proteins and cells. Urine from males can also be contaminated with seminal fluid and will contain chemical markers of renal tubular function for up to three days after ejaculation.

The first source of information regarding test interference should always be the strip manufacturers' product inserts. Specific claims concerning method interference are provided. Test interferences vary according to the brand of strips used. Other references with more extensive information are also available.[1-4]

Abnormal urine specimen color can be a major source of erroneous interpretation of test results. Automatic strip readers may not have the capability of correcting for those colors. Therefore, instrumental results should be verified visually. Dietary substances such as red beets can impart a red color to the urine and mask nitrite, protein, leukocyte esterase, urobilinogen and bilirubin strip pad color reactions. Drugs that impart abnormal colors to the specimen include Indican®, nitrofurantoin (Macrodantin®, Furadantin®), phenazopyridine, pyridium, Azo Gantrisin®, Azo Gantanol® and riboflavin. These drugs may interfere with readings of the nitrite, protein, bilirubin, protein, ketone and leukocyte esterase tests.

The following is a compilation of reported interferences with several reagent strip brands. No

one brand will exhibit all of the interferences that are listed. End-users should refer to the package insert of the specific strip product used in their laboratory.

pH:

No known substances interfere with the test method. However, runoff from the highly acidic protein pad can give a falsely acid pH result.[3]

Glucose:

False Positives

- Contamination with bleach or other strong oxidizers used in cleaners.
- Peroxide contamination.

False Negatives

- High levels of ascorbic acid and/or ketones will inhibit the reaction at 75-125 mg/dL of glucose.
- Generally the reaction decreases as the specific gravity (SG) increases.
- Temperature can also proportionally affect the reaction.
- Allowing the specimen to set for long periods of time at room temperature will allow bacteria to metabolize glucose (glycolysis).

Ketone:

False Positives

- Phenylketone or phthalein compounds that produce red-orange or red color shades that mimic the ketone color reaction.
- MESNA or other sulfhydryl-containing drugs will cause a color reaction that fades on standing. The positive color reaction for ketone bodies either increases or does not fade during the recommended test read time.
- Levodopa metabolites in high concentration may also give a false positive reaction.

False Negatives

- The acetone reaction may be inhibited when glycine is present.
- Improper specimen storage resulting in volatilization or breakdown by bacteria.

Nitrite:

False Positives

- Multiplication of bacteria that occurs if the specimen is allowed to set at room temperature.

False Negatives

- High levels of ascorbic acid will inhibit the reaction at low nitrite levels (≤0.06 mg/dL) of nitrite ion.
- High specific gravity (SG) reduces the sensitivity.
- Lack of dietary nitrates.
- Organisms may be present but they lack the reductase enzymes necessary to convert nitrate to nitrite.
- Extremely large numbers of bacteria may convert nitrate to nitrogen.

Bilirubin:

False Positives

- Indican and metabolites of Lodine®.
- Atypical color caused by bile pigment abnormalities.
- Large amounts of chlorpromazine metabolites.

False Negatives

- Exposure to light will cause photo-oxidation. Bilirubin will rapidly hydrolyze to biliverdin if the specimen is allowed to stand at room temperature.
- High levels of ascorbic acid or nitrites will inhibit the reaction.
- Contamination by chlorhexidine from skin cleansers.

Urobilinogen:

False Positives

- This test is temperature sensitive. The specimen should be allowed to reach room temperature before testing occurs.
- Ehrlich-reacting compounds will impart a similar color reaction. These include porphobilinogen, indican, ρ-aminosulfosalicylic acid, methyldopa, sulfonamides, procaine and chlorpromazine. The extent of cross-reaction depends on the brand of strips used.
- Atypical color reactions are produced by ρ-aminobenzoic acid.

False Negatives

- High levels of nitrites.
- Formalin used as a preservative.
- Old specimens resulting in oxidation to urobilin.

Protein:

False Positives

- Contamination with quaternary-ammonium compounds or chlorhexidine from cleaners or antiseptics.
- Highly buffered or alkaline urines (pH >9.0).
- High specific gravity, particularly in the presence of radiographic dyes.
- Infusions of polyvinylpyrrolidone (blood substitutes).
- Loss of buffer from prolonged exposure of the reagent pad to the specimen.

False Negatives

- Proteins other than albumin present in the urine do not react uniformly with the strip method.

Blood:

False Positives

- Hemoglobin and myoglobin react equally well in the test.
- Strong oxidizing agents used in cleaners.
- Vegetable peroxidases or bacterial enzymes with peroxidase activity.
- Contamination with menstrual blood.

False Negatives

- High levels of nitrite will delay the reaction.
- High specific gravity which prevents lysis of the red blood cells.
- Formalin used as a preservative.
- The drug Capoten® (captopril).

Leukocyte Esterase (LE):

False Positives

- Contamination with vaginal discharge.
- Strong oxidizing reagents or formalin in the collection container.
- Drugs or foodstuffs that turn the urine red in an acid medium.
- Medications containing imipenum, meropenem or clavulanic acid.

False Negatives

- The reaction is inhibited by a high specific gravity, a glucose concentration >3000 mg/dL or a protein concentration >500 mg/dL.
- Presence of cephalosporins, gentamicin and tetracycline decrease the sensitivity of the reaction.
- High levels of oxalic acid.

Specific Gravity (SG):

Specimens with a pH of 6.5 or higher will have decreased readings caused by interference with the bromthymol blue indicator in the pad. Blue-green readings associated with an alkaline pH correspond to low readings. Therefore strip manufacturers recommend adding 0.005 to the SG when the pH is 6.5 or higher[3] Most instruments automatically correct the SG result when the pH is above that level. Instrument manuals should be consulted to confirm that the correction is performed. Elevated readings may also occur when moderate amounts of protein (100-750 mg/dL) are present. Ketoacidosis may also elevate readings.

Glucose and urea concentrations greater than 1% may cause lower reading compared to other methods.

In summary, it should be noted that urinalysis reagent test strips provide rapid and cost-effective methods for screening urine specimens to assist in the diagnosis of disease. The chemical tests are qualitative or semi-quantitative and have varying degrees of sensitivity and specificity. Some degree of interference from medications, dietary substances, improper specimen handling or specimen contamination can occasionally occur. Laboratory personnel and clinicians should be aware of these potential barriers to accurate test interpretation in order to maximize the information gained from the urinalysis.

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Teaching Patients about Glucose Monitoring

By Linda E. Schrock, MN, RN, CS, CDE
Diabetes Program Manager at Elkhart General Hospital, Elkhart Indiana

He came early, choosing a seat in the back of the room. With a big sigh he sat down and tossed the blood glucose meter onto the table, stating, "Well, I'm here. My doctor said I had to come to these classes. He said I've got to do something to get my blood sugar under control."

I sat down and started visiting with him regarding his experiences living with diabetes. I learned he had not tested his blood glucose in three years. The test strip holder and optics of his meter were coated with dried blood. His test strips, several outside the bottle in the carrying case, had discolored. The expiration date printed on the container had passed three years ago. Further discussion revealed he had quit testing because "…it hurt so badly." He looked surprised when I questioned him about changing the lancet and indicated the lancet in the device was the one that came with the machine when he got it.

After cleaning the meter, installing a new battery, obtaining new test strips and control solutions and checking for accuracy, I demonstrated how to change the lancet, showing him the visible difference in the rounded end of the old lancet and the sharp point of a new one. He then reluctantly completed a blood glucose test using careful and accurate procedure to obtain the blood sample and dose the strip. When he had finished, he stated, "That didn't hurt at all. I believe I can do that. Now, show me again how to change that lancet. That really makes a difference."

Home blood glucose monitoring has provided individuals with a useful tool for tracking day-to-day blood glucose levels. The information obtained can be useful to both the patient in observing the results of balancing food intake, exercise and medications and to health care professional in observing many aspects of patient self-care behaviors. However, even a good tool can lose benefit when improperly used.

The American Diabetes Association[1] recommends that patient education by the health care professional regarding accurate testing procedure should be a part of routine patient care both initially at diagnosis, as well as at regular intervals throughout the course of their disease management. Cradock[2] indicates self-management of diabetes is not the responsibility of the health care professional, but is the responsibility of the patient. The individual patient makes most of the decisions effecting outcomes. In addition, the patient is the one who experiences the consequences of the decisions made for self-care of diabetes. She goes on to state "Health professionals need to accept that people make the best possible decisions for themselves given their perception of their situation—most patients have a life beyond their condition. All that health professionals can do is to help the patient start to make informed choices rather than ignorant choices." [2]. To make an informed decision, the patient must be given accurate information regarding the procedure for self-monitoring of blood glucose.

Matching patient need with blood glucose meter features

When meeting with the patient the Health Care Provider (HCP) or Certified Diabetes Educator can unobtrusively observe how well the patient can see by noting if they were reading a magazine when the practitioner entered the exam room or by giving them a relevant health care pamphlet to review. Some blood glucose meters have a larger screen with larger digital numbers. There is an adaptor that can be used as a talking meter for those who are visually impaired.[3]

Some things to consider when collaborating with the patient to select a meter include:

- Ease of use, size and portability of meter.
- Sample size required.
- Time required from dosing strip to result after dosing strip.
- Cost of meter and supplies.
- Special features such as memory, computer compatibility, electronic log format options.

Occasionally a patient will come to the office and state "I want the one that…" and proceed to describe an advertisement they have seen on TV or a personality advertising a specific meter. Arrangements are then made to obtain the preferred meter.

Third party payor considerations

It will be beneficial to the patient financially if information is obtained regarding whether a specific meter is preferred and/or covered under their individual insurance provider. The ongoing out-of-pocket cost of the strips is a significant barrier to adequate frequency of testing blood glucose.

Care of the test strip

Instruct the patient to always use the strips that are the same brand as the meter. Test strips should be stored in climate-controlled environment, protected from heat, light, moisture and dust or dirt. Point out the shelf-life expiration date, how soon after opening they should be discarded, and the code number on the container (if relevant). Patients should be instructed to always store the test strips in the container in which they were purchased and should avoid storing a few strips loose in the carrying case. The seal on unused test strips in multiple-strip disks or canisters should be protected.

Home, family and community safety considerations

No matter the meter desired, it is appropriate to remind the patient to keep the meter, test strips and lancets in a safe place. Bottle caps can be a choking hazard for small children. Drying agents packaged with test strips can be an irritant to the eyes and skin, and can be hazardous if inhaled or swallowed. Test strips should not be cut, altered, or bent. Lancets should be disposed of in a manner designated by local waste disposal ordinances. They should never be "recapped and thrown in the trash."

Teaching the procedure

When opening the meter kit, check the time and date shown on the meter screen. Setting the time to local time will enhance the ability to use the data stored in memory to evaluate the influence food, medication and time of day have on the patient's blood glucose.

The first step the patient should be requested to complete is washing and thoroughly drying their hands. Moisture on the skin surface interferes with obtaining a nicely rounded drop of blood from which to dose the test strip. Residue from food, medication, hand lotion, waterless hand cleaners, and dirt can interfere with the accuracy of the test result, leading to errors of up to several hundred mg/dL.

Most patients anticipate with anxiety actually completing the skin puncture. I prefer to teach them to load the lancet device before inserting the test strip in the meter. It gives them a chance to note the ability to adjust the depth of the lancet. I encourage the majority of patients to start with the setting at mid-depth. For those with calloused or very thin-skinned fingers I adjust the depth of lancet penetration accordingly. Most patients do not want to stick themselves too shallowly, requiring a repeated finger-stick. It is helpful to show a picture of the size blood drop required for the individual meter selected.

Using solution from the test kit, complete a quality check of the meter and test strips. Point out on the meter screen the symbols indicating the meter is ready for the solution to be applied to the test strip. Instruct the patient to do a quality test any time they open a new container of test strips, if they drop the instrument, or if they question the accuracy of the blood test result.

After this demonstration, it is time for the patient to set up the meter for a blood glucose test. For patients who are very reluctant to do that first finger puncture, it is easier if they are instructed to place their finger on a flat surface, position the lancet device and push the button. This positioning decreases the tendency to move the finger slightly away from the lancet as they push the button. It may take as little as a few seconds up to more than 5 minutes for an individual to work up the courage to stick him or herself. This part of the procedure is often the most difficult for adults as well as children.

When doing finger-stick testing, the medial or lateral side of the finger distal to the last joint should be used. Using this site helps protect the nerves in the end of the finger, and thus preserves tactile sensation better. If they do not object to sticking their fingers, I wait to teach flat surface

Procedure for flat body surface blood glucose testing[7, 8, 9]

- Use the appropriate lancing device for flat-surface testing
- Variance from finger-stick to flat-surface test is increased when:
  - ✔ Blood glucose is changing rapidly as happens within 2 hours following a meal, insulin administration, or physical exercise. Use finger-stick testing at these times.
  - ✔ When checking for hypoglycemia use finger-stick test.
- Flat-surface testing may be used:
  - ✔ Prior to meal
  - ✔ Two hours or more after a meal, insulin dose or exercise.
- When using flat-surface testing, refer to the meter's instruction book for correct procedure and sites approved for obtaining blood sample.

Figure 1

testing until they have approximately 4 weeks of testing experience and records for review. Instruct the patient to rotate the site for individual tests, using all fingers in turn. If the patient requests to use flat body surface testing (e.g., the forearm or thigh), I go ahead and teach it at this point. (Figure 1)

Once the test result is shown on the screen, review with the patient their own result compared with blood glucose target at various times of the day such as before and after meals. Even though most meters store results in memory, it is helpful at subsequent visits if the HCP can review a written record with the tests done at a specific time of day recorded in a column.

After the test is completed, review method of lancet disposal that is approved for your community. This information is usually available from the local sanitation department and/or waste disposal companies providing service to the area.

It is also a good time to review the instruction booklet and quick reference guide. Each company has specific instructions listed in the instructional booklet for their lancing device, testing procedure, and parameters to achieve accurate results. Encourage the patient to put the instruction booklet in an easily accessible location, and to keep the quick reference guide with their meter for a quick review prior to the first several blood glucose tests done independently.

Point out where/how to change the batteries, and encourage the patient to change them every year if testing approximately 3 times per day, and every six months if testing more frequently. There is also a 24-hour, 7-days/week help-line telephone number imprinted on the back of the meter and in the instruction booklet.

Follow-up review of test results and blood glucose testing procedure

An accurate procedure for testing blood glucose is essential in obtaining valid results. Research[4] has shown clinicians routinely use more precise technique for blood glucose testing than the nonprofessional when using home glucose monitors. Therefore, it is important the patient be shown the precise technique for testing. At subsequent visits their testing technique should be reviewed for accuracy by asking the patient to complete a blood glucose test in the presence of the HCP. Research findings[4] have revealed there are higher rates of sample volume inadequacies, failure to recognize that an inadequate sample was used, and failure to accurately code the meter to the test strips used.

General points for the health care provider to remember

- Prior to selecting a blood glucose meter, review the patient's hematocrit. The hematocrit range needed for accurate results is specified in the user's manual.
- Instruct the patient to keep the meter clean and dry. If soiled, clean with a soft, lint-free cloth moistened in mild detergent. Prevent moisture from entering the test strip insertion point or around the buttons.
- Show the patient how the results are helpful in improving management of their disease, and of improving the chances of healthy aging.
- Ask the patient to complete a blood glucose test in your presence. Observation of the accuracy of procedure offers opportunity to correct processes that contribute to inaccurate results.
- Compare the results of routine home testing with the HbA1c results. Explain the difference between the results and how each one is useful in managing their disease. Define the target (ADA less than 7%, AACE less than 6.5%) and compare the patient's result with target.
- Effective diabetes care requires a team approach. Those patients who have not achieved target through intervention by the primary health care providers may benefit by a referral to the local diabetes education program.
- Provide the patient with a copy of their lab results, explaining the meaning, and suggesting they keep their copy for future comparison. Seeing actual improvement in test results increases the willingness to continue to be an active participant in improving health care behaviors.
- After reviewing the patient's record book, ask if they are the exclusive user of this meter, and/or if they use any other meter. Then review the meter memory and compare the results with the record book. (I recommend a meter with a memory in all situations. I have seen "perfect" record books—where the results all end with 5 or 0 as the last number, only to find that there are no readings or very few readings in the meter memory).
- When finding discrepancy between the meter and the record book, avoid judgmental statements. Explain how review of accurate and complete data is helpful to you as a health care provider and to the patient in improving outcomes.

Inaccurate sampling, leading to inaccurate results can lead to less than optimal treatment of hypo- or hyperglycemia. Patient education has been shown to be beneficial in improving the accuracy of the patient's blood glucose testing procedure[4]. By asking the patient to complete a test at each visit, the importance of testing and of using accurate technique for each test is re-emphasized to the patient.

Review the results when the patient comes for subsequent visits. You are asking the patient to routinely complete a procedure involves some discomfort, time out of their busy schedule and is a regular reminder of their chronic disease. Adjustments made to patterns of food consumption, exercise, timing and dose of medications used to fine-tune control are based on review of blood glucose patterns. If you as health care provider do not use the results of their diligent efforts, interest in routine monitoring of blood glucose will be lost. The potential of tight blood glucose control, which has been shown to significantly decrease the risk of complications[5, 6] of both large and small blood vessel disease and neuropathy, will be significantly compromised.

Teamwork, with the patient as active participant, and the HCP as coach is essential for control of diabetes resulting in better control of expenditure of health care dollars.

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11. *http://diabetescare.com*
12. *http://www.AACE.com*

Ms. Schrock is certified by American Nurses Credentialing Center as a Clinical Nurse Specialist and by National Certification Board for Diabetes Educators as a Certified Diabetes Educator. In addition, she holds a Master's Degree in Nursing.

Useful HCP and Patient Web Sites

http://familydoctor.org/355.xml
http://familydoctor.org/779.xml
http://www.aafp.org/PreBuilt/smbgmonograph.pdf
http://www.AACE.com
http://www.abbottdiabetescare.com/
http://www.bayercarediabetes.com
http://wwwdiabetes.org/about-diabetes;jsp
http://diabetescare.com
http://www.lifescan.com/
http://www.roche-diagnostics.com/

Target Values for Blood Glucose Tests

	Fasting & before meals	2 hours after starting meal	A_1C
American Diabetes Association (ADA)[10, 11]	90-130 mg/dL	Less than 180 mg/dL	Less than 7%
American Academy of Clinical Endocrinologists (AACE)[12]	Less than 110 mg/dL	Less than 140 mg/dL	Less than 6.5%

Venipuncture Technique

The Clinical and Laboratory Standards Institute (CLSI, formerly NCCLS) is an international, interdisciplinary, nonprofit, standards-developing and educational organization that promotes the development and use of voluntary consensus standards and guidelines within the healthcare community. CLSI has published five editions of venipuncture standards, beginning in 1977 (as a proposed standard); the most recent standard was published in 2003. Following defined standards and procedures in the specimen collection process is essential to laboratory testing because test result is only as good as the specimen that is collected and used in the testing process.

This revised standard addresses facilities, supplies and the procedure itself. It also contains information on difficult collections, special considerations and situations. Revisions include:

- Recommended order of the draw (See Figure 1)
- Detailed information to prevent phlebotomy-related injuries.
- Safety recommendations aligned with the OSHA Bloodborne Pathogens Standard, including:
  - ✔ Discarding the collection device without disassembly.
  - ✔ Stressing that sharps containers should be easily accessible and positioned at the point of use; one-handed needle re-sheathing is no longer acceptable.
- Phlebotomy chairs should be designed for the ergonomic comfort of the phlebotomist as well as providing for both the support of the patient and to prevent falls should the patient pass out.
- Instructions for anticipating syncope and to be prepared to react.
- Caution against using inhalants on fainting patients.
- Procedural changes, including:
  - ✔ Gloving just prior to site preparation instead of prior to surveying for veins.
  - ✔ Inquiring if the patient has a latex allergy.
  - ✔ Greater detail and precautions for site selection, vein selection, needle insertion and needle relocation in order to prevent patient injury.
  - ✔ Releasing the tourniquet immediately upon venous access, if possible (when it is perceived that the release will not interfere with successful collection).
  - ✔ Observation for hematoma formation – requires release of pressure from the site and visual observation of a duration that ensures the detection of subcutaneous bleeding should it be occurring.
  - ✔ Deletion of the previous recommendation of sharply tapping the site to make veins more pronounced.
  - ✔ Recommendation for the use of hypoallergenic bandages.

Venipuncture Supplies

Supplies needed to perform a venipuncture include:

- Gloves (latex, vinyl or nitrile for barrier protection)
- Needles and holders – the selected needle gauge should be based on the physical characteristics of the vein, its location and the volume of blood to be drawn.
- Collection tubes
- Tourniquets (options include a single-use disposable tourniquet – preferably latex free, blood pressure cuff inflated to 40 mmHg or a rubber/fabric-type with a fastening clip). Tourniquets must be discarded when contaminated or if contamination is suspected.
- Antiseptics such as isopropyl alcohol (70%)
- Gauze pads – cotton balls are not recommended as they may dislodge the platelet plug at the venipuncture site.
- Puncture resistant disposal container.
- Adhesive bandages and/or gauze pads, including hypoallergenic bandages.

Order of the Draw

For both plastic and glass blood collection tubes:

1. Blood culture tube
2. Coagulation tube (e.g., blue top)
3. Serum tube with or without clot activator, with or without gel (e.g., red top)
4. Heparin tube with or without gel plasma separator (e.g., green top)
5. EDTA (e.g., lavender top)
6. Glycolytic inhibitor (e.g., gray top)

Figure 1

Venipuncture Procedure

1. Obtain test order.
2. Approach and identify the patient. Phlebotomists should identify themselves to the patient and establish a rapport with the patient. The phlebotomist must have the patient's permission to perform a venipuncture.
3. Verify diet restriction and latex sensitivity; select appropriate gloves and tourniquet. Some lab tests require the patient to fast or otherwise restrict their diet prior to specimen collection. Verify that the patient has followed the restrictions. Due to the increased prevalence of latex allergies, the patient should be asked if they have a latex allergy; a latex-free tourniquet and adhesive bandage should be used.
4. Assemble necessary supplies and select appropriate tubes for requested tests as noted above.
5. Position the patient in a chair with arms (to provide support and prevent falls) such that he or she is comfortable. The arm should be on a slanting armrest and extended to form a straight line from the shoulder to the wrist – the elbow should not be significantly bent. The patient may also elect to lie down.
6. Apply the tourniquet (3-4 inches above the venipuncture site), ensure the patient's hand is closed and select the vein site. The patient's hand should be closed but vigorous hand pumping is discouraged as changes the concentration of some analytes in the blood. The preferred veins are the median cubital (located in the antecubital fossa - the area of the arm in front of the elbow) and the median cephalic (located on the upper or shoulder side of the arm) veins. These veins are typically closer to the skin surface, well anchored, less painful when the needle is inserted and less likely to injure nerves if the needle placement is not accurate.
7. Put on gloves.
8. Cleanse the venipuncture site – allow the site to air dry.
9. Perform the venipuncture; once the flow begins, request patient to open hand. The needle should be inserted into the vein with the bevel up and at a 30° angle. Release the tourniquet as soon as possible after the blood begins to flow. Allow the tube to fill until the vacuum is exhausted and the blood flow ceases.
10. Use the correct order of draw. Obtain additional tubes as required for the ordered tests, in the recommended order of the draw. If the tube has an additive, gently rock the tube back and for the to mix the blood with the additive. Never remove the needle from the site with a tube on the holder.
11. Release and remove the tourniquet – again as soon as possible after the flow begins.
12. Place gauze pad over the puncture site – do not use a cotton ball.
13. Remove the needle, activating any safety feature, according to the manufacturer's instructions.
14. Apply pressure to the site, making sure the bleeding has stopped and bandage the arm. Again, verify that no hematoma is forming before bandaging the arm.
15. Label the tubes and record the time of collection. Labeling information should include the patient's first and last names, ID number, the collection date (and time as required for the test to be performed) and the phlebotomist's identification.
16. Chill the specimen (as required for some tests).
17. Send properly labeled blood collection tubes to the laboratory.

While successful phlebotomy relies on the above noted knowledge and skill base of actually performing successful venipuncture, professional demeanor and positive communication and interaction with the patient is also critical - phlebotomists routinely have to deal with patient anxiety. A cheerful attitude and willingness to listen to and address patients' concerns reflects positively on both the phlebotomist and physician practice.

Sources

1. *CLSI. Procedures for the Collection of Diagnostic Blood Specimens by Venipuncture; Approved Standard – Fifth Edition. CLSI Document H3-A5 [ISBN 1-55238-515-1]. CLSI, 940 West Valley Road, Suite 1400, Wayne, Pennsylvania 19087-1898 USA, 2003.*
2. *http://www.nlm.nih.gov/medlineplus/ency/article/003423.htm*
3. http://www.medscape.com/viewarticle/509098_1
4. http://www.medscape.com/viewarticle/509098_4
5. http://www.vh.org/adult/provider/pathology/CLIA/Phlebotomy/Phlebotomy.html
6. http://www.phlebotomy.com/

To learn more about the standards developed by CLSI, or to purchase a copy of a standard, visit www.clsi.org.

20th POL Symposium Introduces New Education Tracks

COLA and the University of Wisconsin will jointly sponsor the 20th POL Symposium in Baltimore, MD, November 2-5, 2005. The POL Symposium is designed to meet the education and networking needs of physicians and healthcare professionals in the office laboratory industry while providing laboratory professionals with CEU or CME credits. It offers general sessions, workshops, education tracks, as well as an interactive laboratory product exhibit area.

This year's symposium will offer attendees over fifty breakout sessions including new tracks in management skills and technical topics. The 20th POL Symposium continues its focus on providing the laboratory director with basic and advanced information to maintain the physician's office laboratory.

For more information regarding registration, please contact Tricia Hudson, Conference Event Manager, at (800) 981-9883 or by email at thudson@cola.org. To view the symposium brochure online, visit http://www.cola.org/storage/POL05brochure.pdf.

2005-C CME Questions

The material necessary to review to answer the following questions may be found in this issue of the *P.O.L. Insight* and the AAFP-PT *Handbook* or on the AAFP-PT website (http://www.aafp.org/pt and click on Continuing Medical Education). The Test Sheet may be found on page 16 of the *P.O.L. Insight.* The Accreditation information may be found on the inside cover of this issue.

1. True or False: Interferences with reagent strip tests can by physiologic or chemical.
   A. True
   B. False
2. The primary physiological interferences are which of the following?
   A. Volume rate of excretion
   B. Exercise
   C. Incubation time of the urine in the bladder
   D. All of the above
3. True or False: Chemical interferences alter the chemical reactions on the reagent pad.
   A. True
   B. False
4. True or False: If sensitive screening is required for the urinalysis dipstick testing, a timed 4-hour collection is preferred.
   A. True
   B. False
5. True or False: A fasting patient will generally have reduced diuresis and thus a urine specimen should not be collected.
   A. True
   B. False
6. True or False: Exercise can lead to a transient elevation of blood in the urine.
   A. True
   B. False
7. True or False: Protein-to-creatinine or albumin-to-creatinine ratios more accurately reflect the protein excreation by the kidneys.
   A. True
   B. False
8. True or False: Optimum bladder incubation time is 4 to 8 hours.
   A. True
   B. False

9. True or False: The first source of information regarding test interference should always be the strip manufacturer's product insert.
   A. True
   B. False
10. Which of the following medications can cause abnormal color in urine?
   A. Nitrofurantoin
   B. Phenazopyridine
   C. Riboflavin
   D. All of the above
11. Which of the following may cause glucose false negatives?
   A. Contamination with bleach
   B. Contamination with peroxide
   C. Delay in testing with the specimen at room temperature
   D. All of the above
12. Which of the following may cause nitrite false negatives?
   A. High levels of ascorbic acid
   B. High specific gravity
   C. Extremely large numbers of bacteria
   D. All of the above
13. Which of the following may cause urobilinogen may cause false negatives?
   A. Contamination with vaginal discharge
   B. Atypical color caused by bile pigment abnormalities
   C. Using an old specimen
   D. All of the above
14. True or False: The presence of formalin may cause false positives in both urobilinogen and blood.
   A. True
   B. False
15. True or False: The presence of cephalosporins , gentamicin and tetracycline decrease the sensitivity of the leukocyte esterase reaction.
   A. True
   B. False
16. True or False: Specimens with a pH of 6.5 or higher will have a decreased specific gravity reading due to the interference with the bromthymol blue indicator in the pad.
   A. True
   B. False
17. True or False: Ketoacidosis may elevate specific gravity readings.
   A. True
   B. False
18. The information obtained by glucose self-monitoring is useful to the patient in observing the results of which of the following?
   A. Balancing food intake
   B. Exercise
   C. Medications
   D. All of the above
19. Which of the following should be considered when helping the patient to select a meter?
   A. Sample size required
   B. Cost of the meter and supplies
   C. Ease of use
   D. All of the above
20. True or False: It is not necessary to use the same brand of strip as the meter.
   A. True
   B. False
21. True or False: Test strips should be stored in the container in which they were purchased.
   A. True
   B. False

22. True or False: Test strips should be stored in a climate-controlled environment, protected from light, heat, moisture and dust.
    A. True
    B. False
23. True or False: Patients should be instructed to perform quality control any time a new container of test strips is opened.
    A. True
    B. False
24. True or False: For finger-stick testing, the patient should instructed to use the medial or lateral side of the finger, distal to the last joint.
    A. True
    B. False
25. True or False: Prior to selecting a meter, the patient's hematocrit should determined as meters require a specific range for accurate testing.
    A. True
    B. False
26. The HCP should observe the patient perform the test to verify proper technique.
    A. True
    B. False
27. Recent standards changes for venipuncture include which of the following?
    A. Phlebotomy chairs should provide for both the support and safety of the patient
    B. Gloving just prior to site preparation
    C. Observation for hematoma formation
    D. All of the above
28. True or False: Sharply tapping the venipuncture site to make veins more pronounced is no longer recommended.
    A. True
    B. False
29. True or False: Cotton balls should not be used as they may dislodge the platelet plug at the venipuncture site.
    A. True
    B. False
30. True or False: It is recommended that the phlebotomist inquire if the patient has a latex allergy.
    A. True
    B. False
31. True or False: It is recommended that the patient vigorously pump their hand to aid in blood flow.
    A. True
    B. False
32. True or False: The arm should be on a slanting armrest and extended to form a straight line from the shoulder to the wrist.
    A. True
    B. False
33. True or False: The needle should be inserted in the vein at a 45° angle.
    A. True
    B. False
34. True or False: The median cubital and the median cephalic veins are preferred for the venipuncture site.
    A. True
    B. False
35. True or False: The needle should never be removed from the site with a tube still on the holder.
    A. True
    B. False

AAFP-PT CME Test Answer Sheet

ALL INFORMATION MUST BE COMPLETED TO OBTAIN CREDIT

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Please print:

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Select one if you are a physician:

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❒ PED ❒ OB/GYN
❒ Other

Select one if you are laboratory personnel:

❒ MT ❒ MLT ❒ Nurse Practitioner
❒ RN ❒ LPN ❒ Physician Assistant
❒ Med. Assist. ❒ Laboratory Manager
❒ Laboratory Consultant ❒ Other

Evaluation: please fill in bubble between 1 & 5 – 1 denotes poor, 5 denotes excellent:

1. To what extent were the objectives achieved?
   poor ① ② ③ ④ ⑤ *excellent*
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3. Rate your overall degree of satisfaction with this education program.
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4. In what general area of laboratory practice would you like to receive educational materials? (please mark all that apply).
   - ❑ CLIA and/or regulatory. requirements
   - ❑ Good laboratory practices
   - ❑ Test Procedures
   - ❑ Technical Subjects
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   - ❑ Other, please specify

_____

Fill in the circles for the correct answers:

	A	B	C	D
1.	❍	❍	❍	❍
2.	❍	❍	❍	❍
3.	❍	❍	❍	❍
4.	❍	❍	❍	❍
5.	❍	❍	❍	❍
6.	❍	❍	❍	❍
7.	❍	❍	❍	❍
8.	❍	❍	❍	❍
9.	❍	❍	❍	❍
10.	❍	❍	❍	❍
11.	❍	❍	❍	❍
12.	❍	❍	❍	❍
13.	❍	❍	❍	❍
14.	❍	❍	❍	❍
15.	❍	❍	❍	❍
16.	❍	❍	❍	❍
17.	❍	❍	❍	❍
18.	❍	❍	❍	❍
19.	❍	❍	❍	❍
20.	❍	❍	❍	❍
21.	❍	❍	❍	❍
22.	❍	❍	❍	❍
23.	❍	❍	❍	❍
24.	❍	❍	❍	❍
25.	❍	❍	❍	❍
26.	❍	❍	❍	❍
27.	❍	❍	❍	❍
28.	❍	❍	❍	❍
29.	❍	❍	❍	❍
30.	❍	❍	❍	❍
31.	❍	❍	❍	❍
32.	❍	❍	❍	❍
33.	❍	❍	❍	❍
34.	❍	❍	❍	❍
35.	❍	❍	❍	❍

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